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AUTHOR Jacobs, Alan
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ABSTRACT

This master plan focuses attention on the roles computers will play in improving the quality of education over the next 5 years in the Maricopa Community College District. Following an executive summary and introductory material, definitions of instructional computing, computer infusion, and levels of software are presented along with assumptions about students' computer knowledge, telecommunications, library automation, capital spending, county growth, and college-district tension underpinning the plan. Next, the current state of instructional computing at the college is assessed, focusing on computers as the subject of and adjunct to instruction; level of faculty computer sophistication; computer software currently used in instruction; computer hardware available for instruction; administrative and support structures for instructional computing; and current modes for faculty computer learning. Next, the future of instructional computing in the district is discussed, with emphasis on the next 5 years. The next sections consider the needs of instructional computing (i.e., enabling the instructor, providing programmer support, and exerting leadership) and offer recommendations for meeting those needs. Appendices contain information on the development of the plan, interview data, and an outline on computer literacy in Maricopa County. (LAL)

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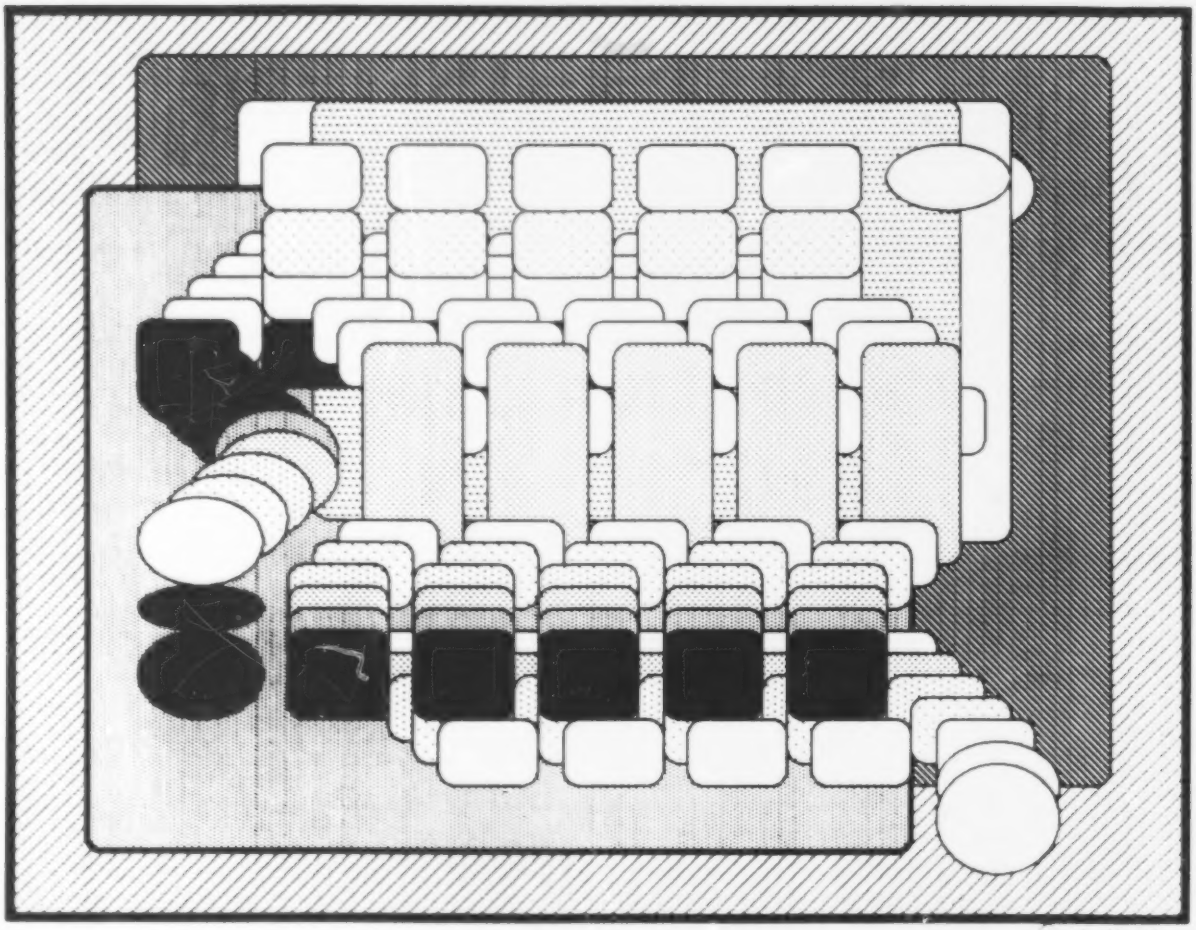

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Maricopa Community Colleges
July 1986

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Master Plan for Instructional Computing

Submitted to

Dr. Alfredo G. de los Santos Jr.
Vice Chancellor for Educational Development

By

Alan Jacobs
Math Instructor, Scottsdale Community College

July 1986

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Chandler/Gilbert Education Center
Ms. Arnette Ward

Maricopa Community Colleges
3910 E. Washington
Phoenix, AZ 85034
(602) 244-8355

Executive Summary

This Master Plan for Instructional Computing focuses attention on the roles computers will play in improving the quality of education over the next five years in the Maricopa Community College District (MCCCD). The Plan defines instructional computing as computing done in the process of instructional acts. The further computing is removed from the direct instruction of students, the less it can be called instructional computing.

Within the Plan, a hierarchy of stages of computer infusion is developed. The measure of infusion is the extent to which instructors make use of the computer as a tool for advancing their instructional tasks.

Stage 1: Instructor becomes computer literate.
Stage 2: Instructor uses the computer regularly for office, preparation, and professional uses.
Stage 3: Instructor integrates computer uses into the existing curriculum.
Stage 4: Instructor reassesses curriculum goals and priorities in the light of skills and knowledge needed in an information-based society.

This hierarchy can be used to measure computer infusion in a college or a department by looking at the percent of faculty at each stage.

Knowledge resources and hardware resources are prerequisites to the further development of instructional computing. MCCCD has a rich hardware environment combined with an eight-year capital commitment to future hardware purchases. Faculty computer knowledge and use has increased dramatically the past five years. Now, 75% of faculty are computer literate.

Using current knowledge and hardware resources as a springboard, the Master Plan for Instructional Computing makes eighteen recommendations to support further integration of computers and instruction. The recommendations are based on analysis presented in the Plan, and are categorized as follows: **Enable the Instructor, Provide Programmer Support**, and **Exert Leadership**. The major recommendations are summarized below.

Enable the Instructor

These recommendations focus on ways to develop the district's computer knowledge resource by enabling the instructor to do instructional computing.

The percentage of faculty who will combine computer use with instruction will triple, from 20% to 60%, in the next five years. This growth will call for a stronger budgetary commitment to software, support and training.

The underlying theme of these recommendations is to build a network through which expertise can be easily exchanged. To this end a bulletin board system (BBS) should be established to facilitate the exchange of ideas in an open forum setting among all the district's colleges. (Recommendation 3) In addition, two funds should be established: one that supports gathering and disseminating expertise, the other that supports the development and integration of educational software. (Recommendations 1, 2, and 2A)

For those instructors who want to develop software, an array of development tools should be provided, for which both instruction and on-going consultant help will be available. (Recommendation 10)

The balance of the recommendations urge improvements in the gathering and dissemination of computing information.

Provide Programmer Support

In addition to being enabled to do instructional computing, faculty want programmer support for their instructional computing ideas.

Recommendation 12 urges the establishment of college instructional computing centers. These centers will provide both programming support and programming advice for writing new software and improving existing software.

Exert Leadership

MCCCD faculty recognize that the infusion of computers into instruction has only begun. They believe that a combination of leadership and vision will play an important role in the success of that infusion.

The Plan recommends that the District draft a royalty/copyright statement which serves to encourage faculty-developed computing projects. (Recommendation 14) Recommendations 13 and 18 urge the computer users groups to assume a greater planning and leadership role. In addition, recommendation 17 urges the review of hardware spending patterns as instructional use of the VAX computers declines and the use of microcomputers increases.

This Master Plan for Instructional Computing has recommended eighteen ways to support and develop the instructional uses of computers both in courses where the computer is the subject of instruction and where the computer is used as an adjunct to instruction. The recommendations and the analysis presented in the Plan should serve to encourage further discussions and planning about the applications of computer hardware and software in instruction.

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Preface

I believe that when the Maricopa Community Colleges make a claim to excellence, that claim stands or falls based on the quality of education given its students.

Among the measures of excellence, efficient business practices and smooth registration procedures are important to the college institution, as are clean buildings and a well-landscaped campus. These are secondary, however, to the ultimate mission of the colleges: quality education as represented by excellent instruction. This Master Plan for Instructional Computing focuses attention on the roles computers will play in improving the quality of education over the next five years in the Maricopa Community College District.

The ideas in this Plan come from a wide variety of sources, but especially 99 computer-using employees, of whom 92 are full-time faculty members. While I take no personal credit for any of the ideas presented in this Plan, I do assume responsibility for taking these ideas seriously. Throughout the document, I have enclosed all direct quotes from the interviews with double quotes (" "). For background information on the development of this Plan, as well as a list of those interviewed, refer to Appendices A, B, and D.

I want to thank the many people who contributed their ideas, plans, critiques and judgments. In a special way, I want to thank Gail Jamieson, Phoenix College, for the cover art; Jan Baltzer, District Office, for the section on Telecommunications; both Laurita Moore, District Office, and Sharon Howard, Scottsdale Community College, for their contributions on library automation; and Mary Day, District Office, for the assumptions on the growth of Maricopa County.

Alan Jacobs

Purpose

The purpose of this plan is to point to the future of instructional computing in the Maricopa Community College District.

° This plan does not end discussion about instructional computing. It serves to direct and to focus those discussions and to ignite further discussions.

° This plan does not end planning for instructional computing. It serves to direct and to focus those plans and to stimulate further planning and budget discussions.

° This plan is not about computing hardware. It is about the applications to which computer hardware and software are used in instruction.

Consider the following metaphor: instructional computing is a park in the Maricopa Community College community. This park now has a 'natural' landscape, whose growth has sprung up from the particular genius of those who have integrated computers into their professional and instructional roles. At present, the park is characterized by haphazard and sporadic growth of an amazingly rich variety.

In this Master Plan for Instructional Computing, Maricopa Community Colleges are *designing* a landscape for the park. The purpose of this landscape design is to work toward a future park which will be characterized by a directed, nurtured and sustained growth of an amazingly rich variety.

Assumptions and Definitions

Instructional computing takes place within a given context. In this section some definitions, models, and assumptions about the future are described in order to specify that context.

A. What is Instructional Computing?

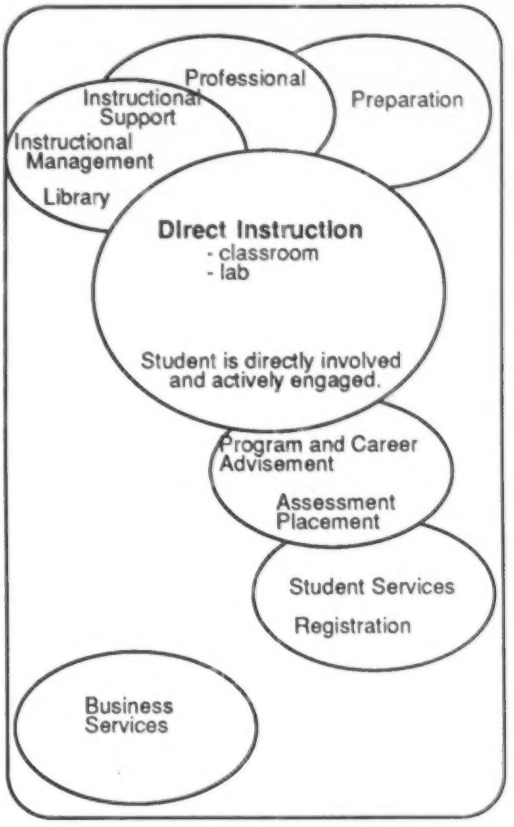
One of the goals in interviewing 99 computer users in the Maricopa Community Colleges was to develop a definition of instructional computing. Each of the 99 was presented with a series of 15 situations involving the use of a computer somewhere in the total college setting. The person was to respond 'yes' or 'no', depending on whether or not that situation represented, for him/her, an example of instructional computing.

In presenting these situations, it became clear that the important word was 'instructional'; 'computing' tended to fall away. For example, if computers are used to generate tests, the real question is: Is test generation an instructional act? "The computer is only a tool," many said. "It is not who (or what) does the task, but the purpose that is served."

The computer, as a relatively new object in the educational landscape, challenges our notions of what is instructional. Sherry Turkle has observed (The Second Self: Computers and the Human Spirit, Simon and Schuster, 1984) that the computer can be a provocation to reflection, opening up long-closed questions. It can stimulate us to reconsider, for example, where we have drawn the lines between instructional and administrative. Our involvement with computers causes us to reconsider the boundaries between the creators of words and the typers of words; between the design and preparation of instruction and the delivery of instruction; between the administrative task of enrolling students and the instruction of appropriately placed students. Furthermore, in those cases where students do all learning for a course by way of a computer -- in some keyboarding classes, for example -- *who is the instructor?* And *what are his/her credentials?*

The computer is already changing the way we've been drawing boundaries. Professorial tasks are changing. One professor reported that he used to give 20 hours of typing each week to a secretary, but now gives no more than 20 minutes a week. He uses word processing on a personal computer to create, edit, and print the final version of class notes. He is much more satisfied with both the process and the end product.

To consider instructional computing, then, caused computer users to re-consider what is *instructional*. The diagram below illustrates what is *instructional*, based on the interview data.



What is *instructional*? The diagram illustrates that those activities which touch on direct instruction are considered, at least in part, instructional. To the extent preparation activities, for example, are focused on the direct instruction of students, they are considered instructional activities. Authoring a program for student use was seen to be more instructional than preparing a test using word processing. As preparation or professional activities become further removed from direct instruction, there is less interest in calling them instructional activities. Various administrative services, summarized by the headings business services and registration, are not considered instructional because they are too far removed from the direct instruction of students.

Instructional computing is computing done in the process of instructional acts; it is computing done in the course of activities which touch on the direct instruction of students. The further the computing is removed from direct instruction of students, the less it can be called instructional computing.

There are still boundaries which are being redrawn. For example, there is strong disagreement as to whether computer-management of instruction is really instructional computing. Consider the fitness centers, which use an instructional management program to determine a fitness plan for each student and to track student progress. It is an example of instructional computing, since it provides a prescription to the student for using the fitness equipment, based on the student's current ability. It is not instructional, on the other hand, because the fitness plan itself does not teach how to manipulate the equipment, or for that matter how to be fit. The computer, in its use as a manager of instruction, continues to challenge the way we draw the boundaries for what is instructional and what isn't.

B. Why integrate computers with instruction?

In one case, computer use is straightforward. When the computer is the subject of instruction - whether the hardware itself, or the system software, programming languages or application programs - students need to be using computers as an integral part of that study. In fact, over the past ten years or so, enormous resources have been placed at the disposition of faculty and students for this kind of instruction. Much of this computer instruction has been vocational in nature, so that justification for the active use of computers has been relatively straightforward. "If we are to have this program (or this course) it must involve the use of computers since that is what business or industry expects of us."

> "...students ...need to respond to the information age within the context of traditional disciplines."

For the larger domain, the rationale for reliance on computers is manifold. Computers are integrated into traditional disciplines for a number of other reasons.

1) Experience is a valuable asset. Through the use of simulations, for example, a student experiences, alters and experiences the universe over again.

2) Students need to learn what the current problems are. Not only are computers an integral part of the discussion of current problems in many disciplines, but computers can expose unsophisticated audiences to the current problems through simulations.

3) Information-access literacy is an important literacy. Computers are one of the principal information-access tools, regardless of discipline.

The computer is interdisciplinary. There is not one department that can claim it as its own. It is a business tool, a scientific tool, a writing tool, a graphics tool, a library tool. Its use is unfolding, as hardware and software improve, to create a legitimate place in every field of instruction.

Instructors see at least two other advantages accruing from using the computer.

4) The instructor can spend more time and energy teaching interpretation concepts and skills than teaching mechanics.

5) The student can use the computer as a powerful tool for learning.

Computers are integrated into instruction, then, not only because all students need access to the productivity and research tools of their discipline, but because they also need to respond to the information age within the context of traditional disciplines.

C. Stages of computer infusion

The hierarchy below provides a framework for describing the infusion of computers into college instruction.

1. **The instructor becomes computer literate; learns how to use a computer.**

2. **The instructor uses the computer regularly for Office/Preparation/ Professional uses.**

3. **The instructor integrates computer uses into the existing curriculum and the classroom.**

4. **The instructor reassesses curriculum goals and priorities in the light of skills and knowledge needed in an information-based society.**

This hierarchy focuses on instructors themselves who have been and will remain the principal

> "...about 75% of the full-time faculty are computer literate."

deliverers of instruction to students. The college system is based on instructors taking responsibility for instruction: the content, the organization of that content, the delivery, the assessment of the student retention of the content and, finally, the ongoing evaluation of the coursework. Even in those cases where instruction is presented by computer, for example, an instructor is responsible for the plan of that delivery, the content of that delivery, and the assessment of student achievement.

The measure of infusion is the extent to which instructors make use of the computer as a tool for advancing their instructional tasks.

This hierarchy can be used to measure infusion in an institution or a department, by looking at the percent of faculty at each stage. Suppose that an institutional goal was to have at least 50% of faculty integrating computer work into the curriculum. That would mean that well over 50% need to have reached stages one and two of the hierarchy.

Maricopa Community College District has had a fairly intense program to bring faculty to a level of computer literacy. Slightly more than 50% of full-time faculty have completed a four-month Faculty Computer Literacy Project. As of this writing, about 75% of the full-time faculty are computer literate.

It is not difficult for faculty to move from computer literacy to regular use. It is necessary simply to for them to have access to computers in their offices, access to appropriate software, and a minimum of training opportunities.

It is more complex, in many disciplines, for faculty to move from regular personal use to stage three, integration into the curriculum for student use. As a prerequisite, faculty need to have an assured availability of both hardware and appropriate software for student use. In addition, faculty need both support and inducements to undertake the integration. Much of this Plan is about that very issue.

Stage four starts with individual faculty questioning the content of curriculum, assuming the continued role of computers and other technologies. But stage four really only takes form with group decisions about curriculum reform.

D. Levels of Computer Software

A major instructional computing issue within the Maricopa Community College District is how much, if at all, the District should support internal development of instructional software. To clarify that discussion, a description of different qualities of software is offered. This hierarchy of qualities of software is drawn by analogy to the qualities of print material used for instruction.

1. Handout Quality:
An instructor writes this material/software for

his/her current classes. These materials are written in the context of a given course, a given text, and maybe even a given class personality. This material may refer to lecture notes or sources available to a limited audience. Since timeliness is a key characteristic of these materials, they may contain mechanical errors. Minimal thought is given to the possibility of colleagues' being able to use this material.

2. Good Handout Quality:
These are the materials/software an instructor uses semester after semester. He/she has revised these materials to the point were there are few, if any mechanical errors. The materials have been tested for educational soundness. They are not quite so context-oriented as level 1 software. These materials are more generalized, illustrating a type of phenomenon or a type of functional relationship. They still relate to a given course but perhaps less to a given text, and definitely not to the personality of a given class. Instructors share these materials with their colleagues on the same campus.

3. Distribution Quality:
These materials/software are useful to others. Not only has the material been thoroughly tested both for mechanical correctness (completely debugged) but also for success in instruction. Documentation is provided the user. The presentation is attractive and consistent. Instructors are willing to share this material with their colleagues within the district, as well as on an individual basis throughout the country. These materials are stand-alone and transportable. They are distributed, nonetheless, as what-you-see-is-what-you-get products. Much of public domain shareware falls into this category.

"High school districts report that fewer students are interested in programming; more are interested in computer applications."

4. Publication Quality:
This software goes beyond distribution quality in that it is distributed in a context of future support. It allows for configuration by the user, if that is appropriate, to a variety of operating environments. This software stands on its own in the commercial marketplace. Production of this software takes 10 to 100 times the resources (time, money) as level 2 software.

E. Assumptions about students' computer knowledge

When instructors were asked how the computing abilities of entering students would change over the next five years, most expected that their skills would improve. Faculty expect students to be "more familiar with computers" and to "be less intimidated" by computers. Students "will have more prior experience with computers." The overall level of experience depends largely on what the high schools will do, and only secondarily on the influence of home computers. Several instructors were concerned that there would be a "widening gap between advantaged and disadvantaged students on yet one more issue: computer access and expertise." The breadth of this gap depends on the influence of home computers, since those who have access at home will have the opportunity to become facile and creative in computer use.

In a study prepared during Spring, 1986, specifically for this plan, the computing curricula and enrollments of the major high school districts in Maricopa County were surveyed. The specific results of this study are shown in Appendix E. The results of this study indicate that over the next five years, 15-40% of high school graduates will have had a one semester course in computers, either programming or business applications. The actual percentage estimate varies widely by district. In addition, however, the study showed that nearly every high school student will have had some hands-on experience with computers in conjunction with a non-computer course in the curriculum or because of a specific computer literacy component in the curriculum.

Although most of the seven high school districts surveyed had one- or two-year strategic plans, only one had long-range strategic plans for computing instruction. Computing courses reside, for the most part, in Business and Mathematics Departments. Mathematics focuses on programming; Business on applications, word processing and some programming. High school districts report that fewer students are interested in programming; more are interested in computer applications. Schools have a decreased ability to offer elective courses, such as computer applications or programming, since the Arizona Legislature has increased the number of required courses for graduation. Many students simply do not have time in their schedule for these electives.

For most of the districts, the business and mathematics courses were only a part of the total computing spectrum, as computers are available and used in a wide variety of different curricular areas. For example, Chapter I remedial classes often use computers as an alternate method of delivery of instruction. Some districts have instituted specific computer literacy modules. Even though large numbers of students will have computer experiences in this manner, rather than in a specific computer course, many students will only be 'exposed' to computers, without the opportunity to become proficient. In fact, the high school curriculum directors tended to agree that students may come out of the 8th grade primed for more computer experiences than the high schools are prepared to offer.

> "...every office will be wired for voice and data communication and every classroom/conference room will be wired for voice, video and data communication by March 1988."

Not all students come to the Maricopa Community Colleges directly from high school. Some of these returning students bring a variety of computer experiences and skills from the workplace. Others, however, return to the community college with no computer experiences at all. Thus, for the group of returning students the computer literacy gap is even wider than for the recent high school graduates.

Within the next five years nearly all 18-20 year old students who went to high school in Maricopa County will have used computers. However, only one-fourth of them will be proficient or comfortable in their use as a result of high school courses. When the experience of using computers at work or at home is added in, approximately one-third of students may be both comfortable and proficient in the use of computers in five years.

F. Assumptions about telecommunications

In October of 1985, MCCCD launched a major telecommunications improvement project to upgrade its telephone/data communciations systems and to link each of the colleges into an interdistrict network that will eventually support voice, video and data communications. Planning for this project has included hundreds of faculty, staff and administrators, and implementation of the project will include training for every full-time and part-time employee within the district.

After construction begins in October 1986, every office will be wired for voice and data communication and every classroom/conference room will be wired for voice, video and data communication by March 1988. On an individual college basis, installation of local area networks will facilitate microcomputer-to-microcomputer communications; installation of a broadband backbone network around each campus will facilitate micro-to-mainframe communications; wiring of every classroom/conference room for voice, video and data communications will provide instructors with access to resources heretofore only available in laboratory settings; improved telephone systems will provide expanded trunking capacity so that colleges can provide additional incoming telephone lines to serve off-campus students and outgoing lines for student access to remote databases.

The intercollege network is being designed to allow immediate and efficient access to all computing and telecommunications resources within the district. This will become increasingly important as centralized projects such as the library automation project are installed.

G. Assumptions about library automation

MCCCD is currently involved in a major project to automate all college libraries and media centers. The major outcome for the students and faculty will be faster and easier access to the information contained in the District libraries. There are a number of subsystems in the automation plan, many of which are designed to improve efficiency of record keeping and the processing of materials. But, there are two subsystems that will significantly alter how students and faculty use the libraries and their resources: the circulation system and the on-line catalog.

The automated circulation system will allow library patrons to check out materials more easily and quickly at any college in MCCCD. Using a light pen and bar codes, much like the UPC codes used in grocery stores, they will no longer have to

write name, address, etc. on the card for each book checked out. We expect to have the circulation system operational by late Fall 1986, at each college in the District.

The other subsystem, the on-line catalog, will bring even more benefits. The cataloging information presently contained on cards in the card catalogs and on COM CAT will be in a computer database, accessed through terminals. This database will contain information on print and non-print materials owned by all of the college libraries. The primary benefit of this system will be the ease with which students and faculty can access this information. They will be able to search for materials using keywords and boolean logic, instead of being restricted to just the limited, often out-dated subject headings assigned by Library of Congress. A book can be searched for even if only a few words of the title are known. The on-line display screen will also be able to tell them which libraries own the book and if it is checked out. We expect the on-line catalog to be operational in January 1987, at each college in the District.

By installing automated systems, MCCCD libraries are well positioned to respond to the information explosion. Future plans will allow the on-line catalog to be accessed by students and faculty from their home or office. In the future the MCCCD automated system will include direct access to the catalogs of several major libraries first in Maricopa county and then in the rest of the country. In addition, we will improve access to the OCLC network of libraries for inter-library loan, which gives us information on materials owned by hundreds of libraries. The new automated system will allow libraries to deal effectively with the increased amount of information that is available only in electronic form.

"MCCCD is currently involved in a major project to automate all college libraries and media centers."

The library automation will bring many benefits, the greatest will be to increase the library's prime function of providing service and information.

H. Assumptions about capital spending, access to hardware

$3,000,000 per year for computer-related purchases, above the ordinary capital allocations (vocational capital, building capital, and ordinary capital), is available to Maricopa Community Colleges for the fiscal years 1985-86 through 1994-95. This capital fund was made possible as a result of a bond election passed in the Fall of 1984 by the voters of Maricopa County.

Of the $30,000,000 in all, 10% is allocated to telecommunciations. The allocation of the remaining $27,000,000 is established by ITEC (Information Technologies Executive Council) and is reviewed on an annual basis. Not only does ITEC determine the distribution of the money per year, but also per institution in the district.

I. Assumptions about the growth of Maricopa County

In 1985 Maricopa County had a population of 1,831,000. This population will continue to increase by 65,000 per year until the year 2000. MCCCD served close to 70,000 students in Fall 1985 in credit courses, including short term and open entry/open exit enrollment. In a given year, MCCCD serves approximately 125,000 students in credit courses. This represents a little more than 9% of the population 18 and over.

Rapid growth of the county's population is the major underlying cause of the tremendous growth seen in the Maricopa Community Colleges.

Traditional students right out of high school will continue to grow in absolute numbers, although there will be fluctuations from year to year. However, the percentage of new high school graduates will decline. New high school graduates currently account for 7-9% of total student body and from 5,000 to 6,000 students each fall. Roughly 40% of high school graduates come to the MCCCD colleges right after they graduate from high school Some high schools send as many as 50% of their graduates to MCCCD colleges.

Arizona has one of the lower high school graduation rates in the country and it appears to have fallen in the past few years. The composition of elementary and secondary students is also changing. While the white birth rate has dropped, the rates for minorities has stayed the same. This means that a significantly higher percentage of these age cohorts will be minority members. Traditionally, colleges have not attracted the same proportion of minority students nor been successful in graduating them.

MCCCD has experienced fairly significant increases in headcount, but decreases in FTSE. For the last several years full-time students accounted for only 25% of the headcount, but for 50% of the FTSE. In the last couple of years full-time enrollment has dropped to 18-20% of total enrollment.

Estimates indicate that in the next 15 years there will be an increase of more than half a million jobs in Maricopa County. This is a 58% growth, and a 3.1% annual growth rate. In terms of absolute number of new jobs created, Phoenix rates fifth nationally. This has tremendous implications for occupational programs and re-training programs.

Arizona rates second (after California) in percentage of the population that attends colleges and universities.

J. Assumptions about College/District tension

The relationship between the colleges and the district office can be characterized by a good news/bad news tension.

The District office serves a support role to instruction in MCCCD.

Good News: In its support role, District has provided information and training to instructors and support personnel; sponsored seminars and conferences; provided a software library and a "wonderful" computer repair department.

Bad News: District generates no FTSE; that is, no money. It does not deal directly with the instruction of students. In fact, "the bureaucracy

"Certain issues call out for centralization, but not at any price."

of the district has put roadblocks in the way of instruction." As more and more resources are needed for maintaining the bureaucracy, fewer resources are available to instruction and the direct support of instruction.

The District Office serves a leadership role to instruction in MCCCD.

Good News: By maintaining a high profile nationally, the District attracts grant and foundation money more easily. The 1985 partnership agreement between MCCCD, Information Associates and Digital Equipment Corporation (DEC), which includes significant hardware discounts from DEC, is an example. By long-range planning, the district is able to anticipate the need for capital money in the future and can initiate a bond referendum for buildings, computers and telecommunications. By initiating and maintaining dialog with Arizona universities at high administrative levels, District makes it possible for students to transfer more easily to the universities.

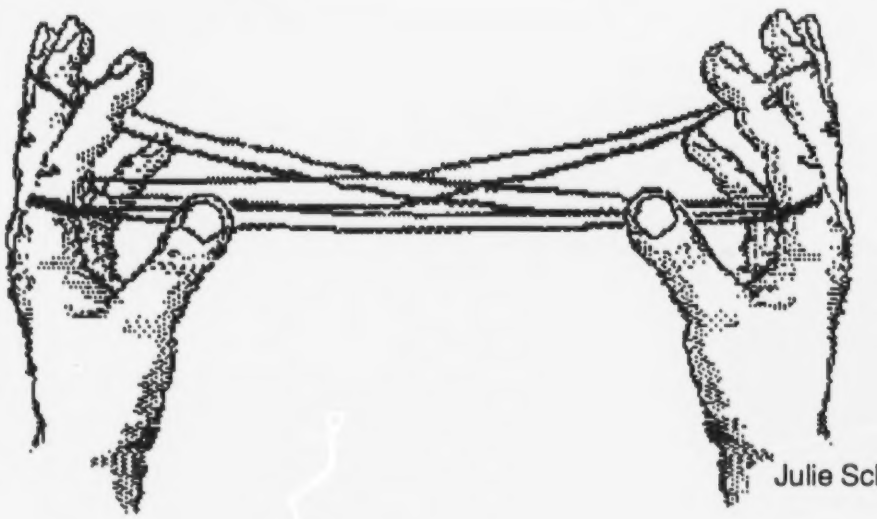
Bad News: Much of the leadership does not meet the real and present needs of instruction. The leadership is out of touch with the nitty-gritty of instruction: what happens in the classroom. The alliance with DEC, for example, "serves administrative needs much better than instructional needs." "I'm sure District has plenty to do, but education seems to have a low priority."

The good news/bad news description illustrates the dynamic tension that exists between the colleges and the district office. Certain issues call out for centralization, but not at any price. For example, site licenses for instructional software can be best negotiated centrally on behalf of all the colleges; yet if central purchasing were to limit software purchases to those titles for which site-license agreements had been negotiated instructional objectives would be undermined.

Leadership and support by the District Office work best when there is close communication between the District Office and those who are led or supported. In fact, leadership and support work

best when an atmosphere of teamwork is developed, working jointly to solve problems of mutual concern. The formation, over the last few years, of user groups for varieties of administrative computing applications shows one way the communication can happen. Each group within the District Office must continually inform itself about the real needs of its target audience. The colleges, on the other hand, need to articulate to the District Office the variety of needs of instructional computing.

In summary, this assumption about good news/bad news tension means that the colleges and District need continually to initiate and to effectively maintain communication on many levels.



Julie Schmidt

Current State of Instructional Computing

The present instructional computing landscape is richly varied, a result of sporadic and sometimes haphazard growth. In the following section, seven different aspects of the present landscape are described.

A. Computers as subject of instruction

In courses where the computer is the formal subject of instruction, several trends are taking place. More of these courses are being offered by a wider range of departments. More of these courses focus on using application programs rather than teaching programming languages.

The past five years have seen a modest increase in the number of departments which have developed computer courses. Three departments, Accounting, Art and Drafting, have begun computer courses where they had none before. Computers, or specific computer applications, are the subject of instruction in **55 different courses, taught in the Spring 1986, by eight different departments**:

Department	No. of Computer Courses (1986)
Accounting	1 course
Art	2 courses
Computer Information Systems	31 courses
Drafting	3 courses
Engineering	4 courses
Electronics	7 courses
Mathematics	5 courses
Office Automation Systems	15 courses

(Some courses are referenced in more than one department.)

A total of 600 sections were offered, generating 1676.6 FTSE, representing 6.3% of the total MCCCD FTSE for Spring 1986.

In Spring, 1981, by contrast, 34 different courses in computers were offered by six different departments:

Department	No. of Computer Courses (1981)
Data Entry	5 courses
Data Processing	18 courses
Electronics	2 courses
Engineering	2 courses
Mathematics	2 courses
Word Processing	7 courses

256 sections were offered, generating 1000.8 FTSE, representing 3.6% of the MCCCD total FTSE for Spring 1981.

A significant trend over the past five years has been a changed focus of the computer courses. There is today a much greater interest in teaching students to use computer applications, rather than to learn programming languages. In MCCCD 32 new computer courses were offered in Spring 1986 as compared to Spring 1981. Of those 32 new courses, 21 of them teach computer applications and only eleven of them teach programming or hardware architecture.

In 1986, as in 1981, the greatest number of students taking classes where the computer is the subject of instruction were enrolled in courses taught by the Business Department (CIS/DP).

B. Computers as adjunct to instruction

The computer is used as an adjunct to instruction in nearly every department in the District, yet the computer usage is more representative of a particular instructor's style than an expectation for a given course.

The best descriptions of computer as adjunct are anecdotal, since there is really no way to quantify this type of usage. The list below is a sampling of the kinds of uses to which computers are put when they supplement or extend traditional courses in the curriculum. The list is by no means complete. Not only are there more departments that use the computer to supplement instruction but also many of the departments mentioned use the computer in yet more ways.

Department
Kinds of computer uses

Administration of Justice
Instructor-written tutorials

Art
Computer art as part of design training

Biology
Tutorials, simulations, database, statistics

Business
Simulations, statistics, linear programming, utilities

Chemistry
Tutorials, drill-and-practice, simulations

Counseling
Career advisement database

Early Childhood
Students evaluate commercial software

Economics
Example generator for economic models

Electronics
Simulations, programming

English
Tutorials, drill-and-practice exercises on grammar

ESL
Tutorials, drill-and-practice

Foreign Language
Tutorials, drill-and-practice on vocabulary, grammar

Hospitality
Simulations,word processing

Mathematics
Statistics, plotting, linear programming, utilities

Music
Ear training

Nursing
Tutorials, simulate hospital computer use

Physics
Simulations, utilities, interfacing with lab instruments

Psychology
Tutorials, simulations, statistics

Reading
Tutorials, drill-and-practice

Learning Assistance Center
Tutorials, drill-and-practice

While the above sampling of uses shows that computers are used in a wide variety of situations within MCCCD as an adjunct to instruction, implementation of these computer activities has

> "The computer is used as an adjunct to instruction in nearly every department in the District..."

occurred usually by the initiatives of individual instructors, rather than departments. As a result, these activities have been integrated with courses of specific instructors and not, generally, standardized within a department. For example a student taking Introduction to Psychology 101 from instructor A may run tutorials, simulations and statistics programs on the computer while a student taking the same course, at the same college, may do no computer work when the course is offered by instructor B.

The sampling of uses also reveals limitations in the development of instructional computing. The list above would not have looked substantially different three years ago. While instructors are expanding their personal/professional expectations about computers, the lack of computers for faculty, the lack of computers for student use, and the lack of suitable software has limited the growth of instructional computing.

For the reasons given above, the instructional computing landscape looks both richly varied and haphazard; the landscape is still experimental -- still in 'beta test'.

C. Level of faculty computer sophistication

Using the stages of computer infusion hierarchy from page 7, MCCCD faculty may be characterized in the following way:

1. 75% of MCCCD full-time faculty are computer literate. That is, they have either

completed the Faculty Computer Literacy Project (50-55%) or have become knowledgeable by other means.

2. 25-30% of MCCCD full-time faculty use computers regularly for preparation and other office/professional tasks. This figure will grow to about 50% during the 1986-87 school year, as more faculty are equipped with office computers.

3. 15-25% of MCCCD full-time faculty integrate computer activities with at least one of the courses they teach, based on extrapolations from the interview data.

4. 5% of MCCCD full-time faculty are engaged in a formal reassessment of curriculum as a response to the information age.

About 10% of the faculty have authored programs or lessons for use in instruction. At least five instructors have written or designed programs which are being sold commercially.

There is a very positive attitude among faculty toward using the computer, both for professional and office uses and for instructional purposes. As hardware and suitable software have become available, instructors have been eager to use them. On the other hand, many instructors have found their eagerness turn to frustration because of lack of access to both hardware and software for projects they have wanted to do. At each stage of the hierarchy, faculty serve as catalysts to each other. The system is enriched as energy, knowledge, skills, and enthusiasm are directed back for the benefit of others. Moreover an instructor's enthusiasm for computers serves to enliven the individual and to renew enthusiasm for all aspects of teaching.

D. Description of current computer software used in instruction

For those courses where the computer is the subject of instruction, virtually all the software is commercial software. All computer application courses use commercial software (usually best-sellers), whether in business applications, word processing or art and drafting. The only exception to this is when instructor written tutorials might supplement regular instruction. For example, a set of tutorials on VAX BASIC has been in use for several years, supplementing instruction in the BASIC language courses. In some cases commercial software is sold to students with published manuals, through the bookstore; in other cases lab copies of the software are provided for student use.

Where the computer is used as an adjunct to instruction, the quality of the software shows much greater variance: from worksheet quality to commercial quality.

While a detailed review of the drill & practice and tutorial software authored within the district has not been made, some general observations are possible. Most of these lessons are written in BASIC, SuperPILOT, or TEACH, an MCCCD authoring language available on the VAX computers. In fact, at last count, over 600 TEACH lessons were available on the VAX. The

"About 10% of the faculty have authored programs or lessons for use in instruction."

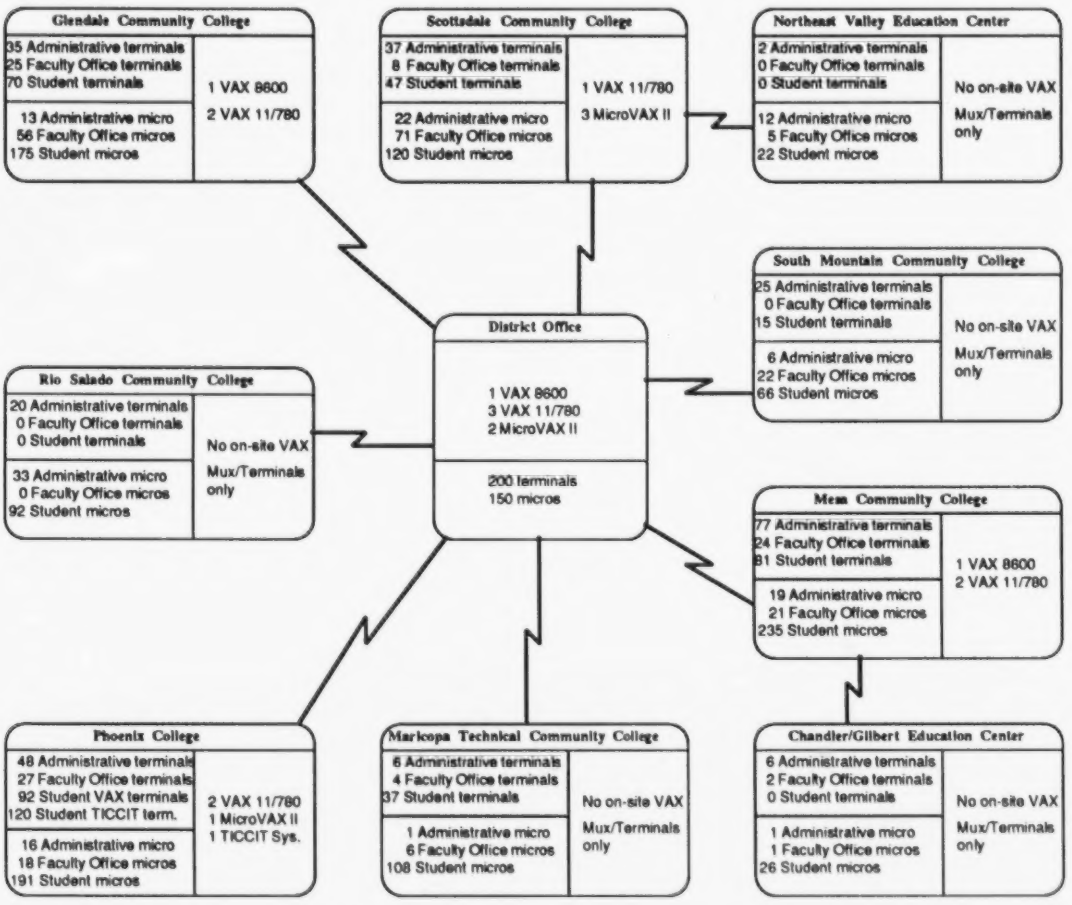
lessons show a wide variance in style, use of graphics and humor, and instructional design. Most of the tutorials are topic-oriented rather than comprehensive, course-length sets of lessons. Most of this software falls within level 2 of software quality: good handout quality.

At Phoenix College, a TICCIT system for CAI delivery has been in operation for a decade. TICCIT is an exception to the circumstances described in the preceding paragraph. Whole courses in Algebra, for example, are available on TICCIT. And, TICCIT provides a consistent instructional design for the lessons that are written.

In addition to drill-and-practice and tutorial software authored within the district, many other programs have been written for student and faculty use. These include a variety of statistics programs, several gradebook programs, test-bank and item analysis programs and function plotting programs. This tool and simulation software tends to fall within level 3, distribution quality and level 4, commercial quality.

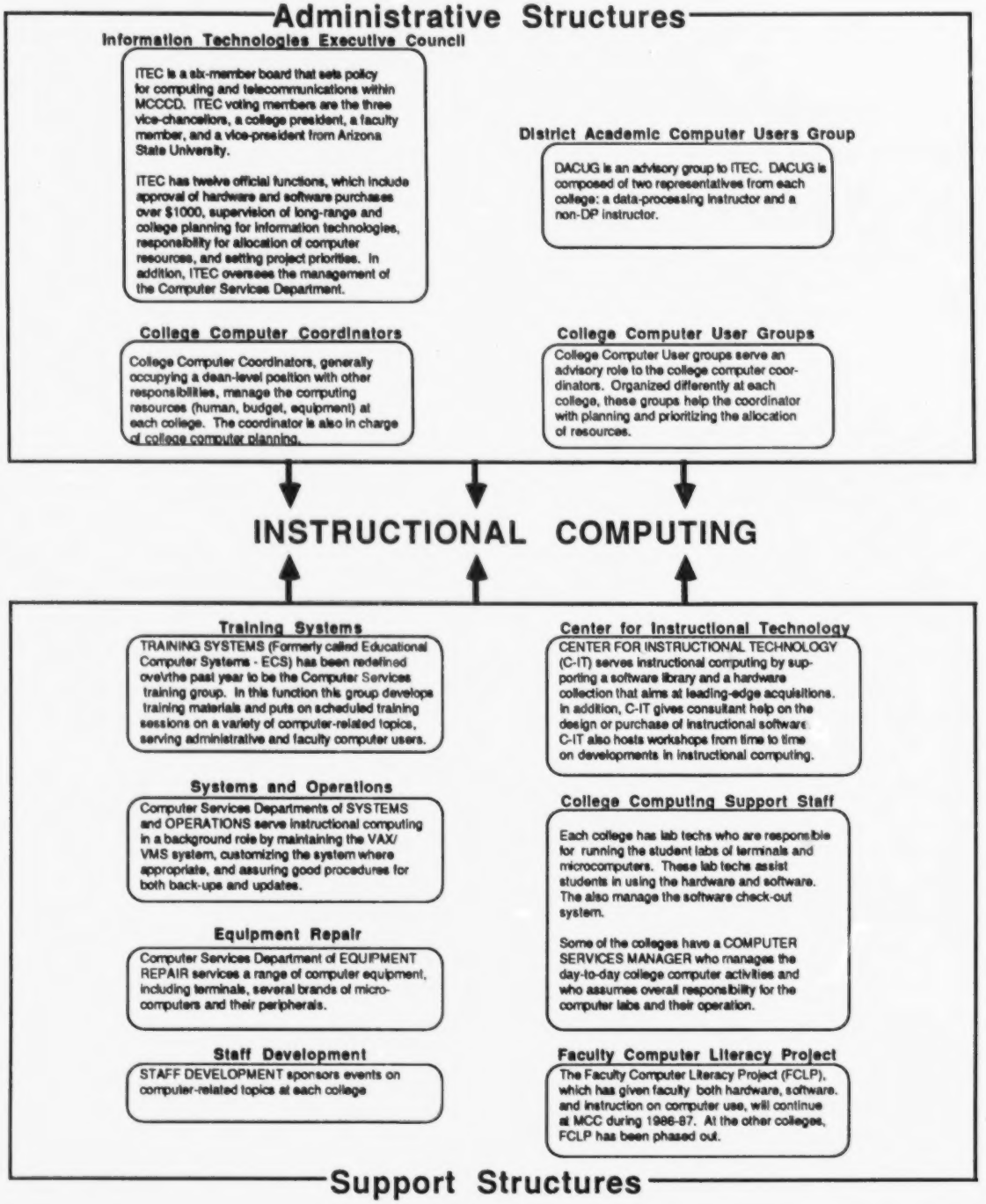
In addition to MCCCD-written software, many instructors use commercial software as an adjunct to their courses. Many statistics courses, for example, have used Minitab on the VAX computers. Some instructors use LINDO, a linear programming utility program. On micro-computers, commercially available simulations are used in a wide variety of courses, from respiratory therapy to physics. Other instructors have integrated commercial tool software into their teaching. For example, one instructor's students use a database program to search for and identify cells based on observed characteristics. English faculty are beginning to make word processing and text analysis tools a part of composition instruction.

E. Computer Hardware available to instruction



The above information was gathered in May 1986. In only two months the figures are radically out-of-date. The above chart documents 2500 micro-computers and terminals in the district. For Fall 1986, at least 1600 more will be purchased.

F. Administrative and support structures for instructional computing


Administrative Structures
Information Technologies Executive Council
ITEC is a six-member board that sets policy for computing and telecommunications within MCCCD. ITEC voting members are the three vice-chancellors, a college president, a faculty member, and a vice-president from Arizona State University.
ITEC has twelve official functions, which include approval of hardware and software purchases over $1000, supervision of long-range and college planning for information technologies, responsibility for allocation of computer resources, and setting project priorities. In addition, ITEC oversees the management of the Computer Services Department.
District Academic Computer Users Group
DACUG is an advisory group to ITEC. DACUG is composed of two representatives from each college: a data-processing instructor and a non-DP instructor.
College Computer Coordinators
College Computer Coordinators, generally occupying a dean-level position with other responsibilities, manage the computing resources (human, budget, equipment) at each college. The coordinator is also in charge of college computer planning.
College Computer User Groups
College Computer User groups serve an advisory role to the college computer coordinators. Organized differently at each college, these groups help the coordinator with planning and prioritizing the allocation of resources.
INSTRUCTIONAL COMPUTING
Training Systems
TRAINING SYSTEMS (Formerly called Educational Computer Systems - ECS) has been redefined ovelthe past year to be the Computer Services training group. In this function this group develops training materials and puts on scheduled training sessions on a variety of computer-related topics, serving administrative and faculty computer users.
Center for Instructional Technology
CENTER FOR INSTRUCTIONAL TECHNOLOGY (C-IT) serves instructional computing by supporting a software library and a hardware collection that aims at leading-edge acquisitions. In addition, C-IT gives consultant help on the design or purchase of instructional software. C-IT also hosts workshops from time to time on developments in instructional computing.
Systems and Operations
Computer Services Departments of SYSTEMS and OPERATIONS serve instructional computing in a background role by maintaining the VAX/VMS system, customizing the system where appropriate, and assuring good procedures for both back-ups and updates.
College Computing Support Staff
Each college has lab techs who are responsible for running the student labs of terminals and microcomputers. These lab techs assist students in using the hardware and software. The also manage the software check-out system.
Some of the colleges have a COMPUTER SERVICES MANAGER who manages the day-to-day college computer activities and who assumes overall responsibility for the computer labs and their operation.
Equipment Repair
Computer Services Department of EQUIPMENT REPAIR services a range of computer equipment, including terminals, several brands of microcomputers and their peripherals.
Staff Development
STAFF DEVELOPMENT sponsors events on computer-related topics at each college
Faculty Computer Literacy Project
The Faculty Computer Literacy Project (FCLP), which has given faculty both hardware, software, and instruction on computer use, will continue at MCC during 1986-87. At the other colleges, FCLP has been phased out.
Support Structures

G. Current modes for faculty computer learning

1. Staff presentation. At the District Office, Training Systems, formerly known as ECS, has served this function for at least 6 years. Training Systems has trained faculty on a wide variety of software from authoring languages to item analysis programs to cognitive style mapping programs as well as keeping the programming instructors up-to-date on system changes. Training Systems directed the FCLP (Faculty Computer Literacy Project) for over 2 years, teaching most of the sessions. During that same time Training Systems taught many of the FCLP modules to hundreds of interested faculty and staff. After FCLP was distributed to the colleges in Fall, 1985, Training Systems has continued to train both faculty and staff, though its emphasis is changing to include more training for administrative applications.

In addition to Training Systems, the Center for Instructional Technology (C-IT) has emerged as a training resource over the past 3 years, presenting seminars on authoring languages and computer assisted instruction. Staff associated with C-IT taught several strands in the FCLP.

In other words staff presentation has been very important in enabling both faculty and staff to do computing.

2. Staff consulting. Both Training Systems and C-IT answer questions on a daily basis, over the phone and in person. In fact, Training Systems does as much as 25% of its training by answering questions over the phone. They've been valuable resource consultants not only about the specific and general use of software and hardware, but the selection of software and hardware. Training Systems and C-IT have their own constituencies which recognize them as central sources for information about computing. To a lesser extent the professional computing staff of MSCS (Management Systems and Computer Services, the district's data processing department) has also assumed consulting roles for technical support of instructional computing.

"(Peer consulting) takes advantage of the decentralization of expertise by using a team of campus experts."

At the colleges, the coordinators of computer services and lab technicians have served both faculty and staff in a consulting role on operational issues and software selection, and in trouble-shooting hardware and software problems.

3. Peer presentations. This model has been gaining in use over the last year or so. When FCLP was decentralized to the colleges, faculty, rather than staff, continued the instruction. Additionally, several staff development coordinators have asked faculty to lead seminars on a wide variety of software and hardware topics.

District Computing Services has used faculty, staff and vendor presentations, in its Penguin Hour series, to keep its staff and others up-to-date on developments within computing.

Faculty have strongly approved this mode of delivery of information on computing.

4. Peer consulting. Since computers first appeared, faculty have shared information, enthusiasm, and ideas with each other. This happens spontaneously, but not consistently, as interests peak and energy wanes. An attempt to institutionalize the peer consulting model was made at GCC during 1985-86. Five instructors were each given 3 hrs release time per semester to be available to the faculty-at-large. Their areas of responsibility were delineated around their areas of interest and expertise. For example, one instructor was the designated Macintosh expert. Others specialized in MS-DOS. In addition to being 'on-call', some of the consulting group were responsible for organizing hardware and software demonstrations. Others gave presentations during the year.

This mode effectively and efficiently takes advantage of the decentralization of expertise by using a team of campus experts.

5. Existing courses. Both faculty and staff have, to a small extent, enrolled in regularly scheduled courses in MCCCD or at other institutions. Courses in either programming languages or applications on Word Processing, Spreadsheet, and Database have been most frequently chosen. There are, however, no courses which might constitute a post-literacy path for

faculty computer learning, either in authoring Languages or in Educational Courseware Development.

6. Self instruction. Many faculty prefer to learn software directly from the user's manual, in the comfort and privacy of their own office or home. For this kind of self-instruction to succeed, faculty need time, software, hardware, and access to information. The internal funding sources for innovation, JCEP, DEDP, and EDP, provide some resources for time, software and information for the development of instructional products. However, computer self-instruction has not been a priority for funding. A fresh start for funding development of instructional software, for directly enabling the instructor, follow in the Recommendations Section.

Future of Instructional Computing

A. A vision

The impact that new technologies have already had on education provide clues about the future. Steven Gilbert, in a recent article for the Bulletin of ACM, states, "Computers, in conjunction with other forms of information technology, will revolutionize the learning process in higher education and elsewhere...eventually. We cannot clearly predict the form or the date of this revolutionary change, but it will be sufficiently dramatic to be unmistakable; it will be more than the accumulation of subtle alterations.

"In other words, eventually there will be a breakthrough for instructional applications of information technology similar in impact to that of word processing and spreadsheet software. Anyone who has frequent need to perform tasks that can be aided by word processing or spreadsheet software, and who samples these applications, needs no further justification for using a computer, needs no cost-benefit analysis. Eventually, software of equally obvious benefit for learning will be created." ("Academic Software--Vision and Perspective", SIGGUE Bulletin of ACM, vol 18, No. 2-4, Winter, 1986.)

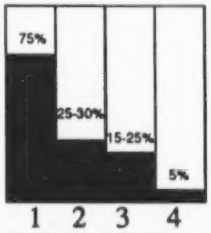
The developments of high-quality computer-based-education (CBE) since the 1960's, exemplified by PLATO and TICCIT, have been disappointing, not in the quality of the software so much as in their limited adoption. On the other hand the adoption and use of computing tools (word processing, spreadsheet, and database) has been widespread.

A new generation of software appropriate for learning is emerging. This software resembles the Pinball Construction Set program, where the user creates a pinball playing surface -- and then plays computer-simulated pinball. Construction sets applicable to many disciplines will provide both instructors and students the opportunity not only to develop discipline-specific experimental models, but also to simulate how the model works over time.

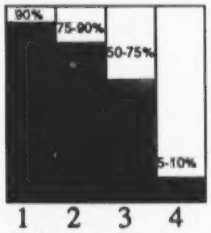
While CBE will continue to influence instruction, it will not grow as fast as the use of open-ended, tool and simulation software.

B. The next five years

The next five years will see the movement of large numbers of faculty in MCCCD from stage1 (computer literate) to stages 2 & 3 (active use of computers in the office and in instruction). The graph below compares the computer infusion in MCCCD in 1986 to a projected infusion in 1991.



Infusion Stages
1986



Infusion Stages
1991

The number of instructors actively using computers will triple over the next five years. This will place increased burdens on the allocation of resources for support of instructional computing. The growth within stage 2 (using computers for office/professional tasks) will be made possible by the purchase of office computers and by the readiness of large numbers of faculty. For stage 3 even more resources will be needed. Not only will sufficient student computers and software be needed (tripling the number of student workstations), but also increasing the support and inducements for faculty. Most likely, this new group of faculty using computers will need greater

levels of support than faculty currently using computers.

The next five years will see a widening use of computers within every discipline, following, however, the same models that have been established the last few years:

a) The use of the computer as a supplement to the delivery of instruction: tutorials, drill & practice.

b) Use of computers as a tool of the discipline: statistics, databases for Social Sciences, word processing and text analysis for English, etc.

c) Use of simulations, including construction set software.

d) Establishment of a few new courses for concentrated instruction of computer applications within a specific discipline.

The next 5 years will see the expansion of these uses to other disciplines and to a higher percentage of faculty within each discipline.

At present, an instructor who wants to use the computer as a supplement to his/her non-computer discipline must devote class time to teaching how to use the computer--too much class time report many instructors. In the future instructors will give computer-oriented assignments with a minimum of explanation of the mechanics of using the computer or even a particular program. Students will already

1) have overcome the fear of using the computer,

2) know what to expect from a computer, what to expect it to be able to do, and what to expect in terms of its operation,

3) be familiar with several different kinds of software, so that it is relatively easy to learn new applications.

In other words, instructors will be able to assume a certain level of computer familiarity.

Data from the high schools indicates that literacy levels 1) and 2) above will be met by most high school graduates over the next five years. It appears, however, that 20-30% of high school graduates (about the same as now) will have had opportunity to get to really learn and use different software packages.

In the future, students will do assignments for the class on computer and some of these assignments would be instantly graded by computer and recorded in a data base. At intervals, the data will be analyzed and reports written to both students and instructor. This is not new, but it has been made more complex because of stand-alone microcomputers. To realize this future will involve networking schemes, where the student's scores are logged to a central file server. Since MCCCD has practically no experience in using networks of microcomputers for instructional applications, this future will require special leadership and encouragement.

"The number of instructors actively using computers will triple over the next five years."

Over the next five years, instructors will place more reliance on commercial software for instructional applications. Much of this software, however, will be tool software or construction-set software. That is, the software will allow for discipline-rich development by both instructor and students.

Instructors will continue to design, write, and assign drill-and-practice sets and tutorials for students, on a topic-by-topic basis. These lessons will be available to all instructors throughout the district, via a central distribution system. Large-scale CBE, like TICCIT, will continue to serve instruction. In fact, this use will grow as instructors want more sophisticated tools for managing computer assisted instruction.

With the automation of the libraries in the district, the faculty will have the opportunity to teach current methods for accessing information. Since students will have access to much greater amounts of information, they will need to learn appropriate search strategies to retrieve the information they want. In fact, on-line search strategies, incorporating boolean logic, keywords and context searching, can often access information in a way that simply isn't available through manual means.

Part of student's learning will be not only what books and materials are available in the colleges' libraries but also what is available on-line in unpublished information and statistical databases.

C. How will instructional computing be institutionalized?

An interesting problem manifests itself when integrating computers with existing curriculum. Here's a current example. Some english faculty have become committed to the strategy of using word processing and writing analysis software to teach freshman composition. Once the software and hardware are selected, and space is found to house it, there are at least four choices of how to actually implement this approach:

1. Create a new course called Freshman Compostion with Computers, ENG101A. List this course in both catalog and schedule as an alternative to the normal ENG101.

> "I'm a much better teacher, much more engaged intellectually, ..."

2. Create a new 1 credit course called Word Processing for English Composition, which students would register for in conjunction with certain sections of ENG101. In this additional course students would be taught the mechanics of using the computer and the writing analysis software.

3. Flag those sections of ENG101, in the published schedule of courses, notifying students upon registration which sections will use the computer.

4. Surprise the students the first day of class.

All have been tried in the past by other departments. It is not clear which of these choices will be chosen for Freshman composition; nor is it clear which choices other departments will make as they face similar decisions in the next five years.

Based on the discussions of what is instructional computing, catalog descriptions for existing courses won't change to include the words '...and will utilize computers to...', just as the course descriptions for Trigonometry have not been changed to include '...and will use calculators to....' It is the subject matter, not the computer, that is the key.

D. The computer's dual nature: burden and liberation

In an honors class this Spring, some students were discussing their future in a society where computers proliferate. The students expressed serious reservations about this future: they feared being 'chained to a CRT' serving the machines of the information revolution the way previous generations served the machines of the industrial revolution.

Faculty who were interviewed for this report don't experience the computer this way. Faculty see the computer as an extension of personal power. They're not chained to it; in fact, they experience the computer as a liberating tool. "I manage my life on the computer." "I'm a much better teacher, much more engaged intellectually, because of the savings in time word processing affords me." "I can type twice as fast using a computer as a typewriter--and I'm a good typist." "My theme grading program saves me so much time that I can write individual comments of a positive nature in addition."

The honors students and faculty expressed radically divergent views of the computer. Karl Marx observed the same dichotomy about work, commenting how some people experience work as a burden while others experience work as a path of personal fulfillment. Even more pertinent to the information revolution, however, Marx had drawn a distinction between *tools* and *machines*. Machines, he noted, impose their own rhythm on the worker, while tools are an extension of the worker's own uses. The honor students mentioned above, then, were fearing the computer as machine while the faculty embrace the computer as tool.

This dual nature of the computer has fairly serious implications about the way computer applications are integrated into the curriculum. In planning

discipline-related computer assignments, faculty need to be wary of making false assumptions about the way students experience the computer. Just because faculty experience the power, flexibility and convenience of the computer in writing tutorials or spreadsheet applications or doing statistics or graphics, for example, doesn't mean that the students who perform these assignments as a part of a grade for a course will experience the computer in the same way.

In fact, when a student feels lost inside the labyrinth of a poorly written tutorial, he/she may well feel 'chained' to that computer -- or at least that tutorial program. To the extent that tutorials (or any program for that matter) 'impose their own rhythm', the computer exhibits its machine nature.

While it is necessary to subject oneself to machinery from time to time, education ought to integrate the computer in instruction in such a way that students experience it as an empowering and liberating tool.

E. VAX flight

In the past five years virtually no new instuctional computing applications have begun on the VAX. All new usage has taken place on microcomputers. This trend will continue because so much more of what instructors want to do is on micros, not on the VAX.

Unless additional applications are made available on the VAX, no increase in instructional VAX use is foreseen for the next 5 years. In fact, some further decrease may be predicted. In Fall, 1986 the lab portion of Survey of Data Processing, for example, will move from VAX-based programming assignments to micro-based application assignments.

Needs of Instructional Computing

Instructors were asked "What resources will you need for your own computing projects?" and "What kind of support should the college or district provide for computing?"

The following encapsulates the answers to those questions: **Enable the instructor** to do the job that needs to be done. **Provide programmer support** to target development of in-house instructional software. **Exert leadership** to ease the transition and define the new roles for faculty embracing instructional computing.

A. Enable the instructor

Faculty believe that the job of integrating computers and instruction belongs to them. "Enable the instructor" means to provide instructors the wherewithal to get the job done. The following paragraphs articulate that wherewithal.

First of all, the instructor needs time: time to learn new software or programming languages, time to set up course changes and evaluate them, time to seek out and review existing software. "It's hard to be innovative at 15 hrs/sem normal load." "In our department we all carry overloads during the year. We can really use summers for training and product development."

Besides time, money is needed for both hardware and software. Despite the availability of $3,000,000 per year for computer-related purchases, many departments are not able to proceed with their own vision of the future because of the lack of computers, either for faculty or for student use. Even where good quality software is known, present computer hardware will not support the addition of more student use.

The departments need to buy incidental copies of software for review, learning, or for use in development. "We need a software budget. The supply budget is totally inadequate." When the implementation of computer applications involves enough copies of commercial software for entire classes to use, the current budget categories are simply inadequate. Some of the colleges have a college software budget, which can be used for departmental purchases. This works best for small, inexpensive orders, but it has been difficult to buy expensive software even in single copies.

Beyond time and money, instructors want training and information support for the computing tasks that need to be done. Instructors want "training on current software, like SMART, Framework, Multimate" and on integrated programs ranging from Appleworks to Lotus 1-2-3 to JAZZ. In addition to *how-to* training, instructors want to learn to use development tools, whether they are programming languages, authoring languages or other development tools. Faculty asked for help in the design of educational software, as a part of a product design and development project. Some of this training, as in the development tools, needs to be both long-term and in-depth; but most often there is a need for short seminars which provide "specialized training from time to time."

Faculty want better access to information about computers and their discipline-related applications. Ask an instructor a question in his/her field of knowledge -- whether about facts, strategies or

> "It's hard to be innovative at 15 hrs/sem normal load."

philosophical differences -- and he/she will have no difficulty in rendering an opinion and knowing where that opinion lies relative to his/her colleagues in the same discipline. This is true not only because of extensive formal education, but also because the instructor remains professionally active. Since the computer is a relatively new phenomenon in education, instructors have had little or no formal education in its use -- and

certainly less in its application to the instructional setting. "We are all still learning what the computer can be used for" in education. As hardware and software change rapidly, it becomes very difficult to keep abreast of current technology. But it is equally hard for instructors to keep pace with how their colleagues are using computers with instruction, as that changes from year to year. For this new technology, instructors need better information about what others are doing. They'd like to know what software and hardware their colleagues at other colleges have, what computer applications they find useful, how the course content has been affected, what implementation strategies are successful, what training is needed, and how the problems of funding have been addressed.

"We need to share what's been done at other campuses" to avoid duplication of effort. We also

> "...instructors want access to a professional programmer to produce quality software."

"need to know who has what software and who has expertise." As one instructor put it, "It's all about information and the exchange of information, not just at MCCCD, but around the country." Faculty need better ways to communicate with each other their uses of computer technology, even among colleges within MCCCD. Not only should it be possible but easy for departments to share reviews and experience with both commercial and user-written software.

While the most important information is what others are doing in instruction, there were other common information themes. Instructors want access to advice on purchasing hardware and software. In some cases, all that is needed is a verification of the necessary peripherals. In other cases, the instructor is looking for frank advice on the selection of hardware and software. Should I get IBM or Mac? Is networking with a file server appropriate for this situation? What computer hardware is currently supported by District Repair? Faculty look to the District Office as a trustworthy source for this information.

Once the hardware and software are selected, there is a need for accurate information about the current prices available to the District. The hardware price information is fairly well publicized, but software prices are not. Keeping up with software prices is a much bigger problem than hardware, since it involves hundreds of vendors. Nonetheless, the purchasers and users of software need to have access to the best prices available.

Instructors expressed the need for better information about MCCCD procedures and policies in two areas relating to computing: hardware repair and purchasing. The purchasing department has been overwhelmed with the volume of computer-related requests that have come on top of the normal purchasing flurry. Several instructors felt that if they were better informed about purchasing policies and procedures, they could do a better job at the origination and thus the entire acquisition process could work more smoothly. The District provides excellent hardware repair, but faculty are not sure who to call during the warranty period. There is also some confusion about exactly which computers and peripherals will be serviced.

Enabling the instructor requires providing him/her with time, money, software and hardware, training and access to a variety of information.

B. Provide programmer support

In addition to being enabled, instructors want access to expertise, especially programmer support, in taking over some of the tasks involved in completing computer projects. There is a fairly consistent indication that instructors want access to a professional programmer to produce quality software. In some cases, faculty want no personal part of programming at all; in other cases, they are looking for programming tips and advice from an experienced programmer. In all cases where a programmer is involved, there is a need for project coordination or even project leadership, so that projects can be completed in an orderly fashion.

Sometimes, instructors just need to talk to someone to develop an idea into a plan, or at least to discuss the feasibility of the idea. That person needs to understand instructional needs as well as to be experienced in the implementation and development of educational software. In other cases, instructors want to discuss screen design or

branching design with an instructional designer.

The stated support needs for product development were much less varied than the support needs for enabling the instructor. This probably reflects the current state of computer infusion in MCCCD. There is a clearer sense of the needs for instructor growth and development and thus more varied and individually specific. Most faculty have, correspondingly, a somewhat less clear sense of the process and scope of serious product development.

There is evidence that faculty could make good use of programming assistance. Some teams of subject-matter experts and programmers have developed useful products within MCCCD. However, most successful integrations of computers and instruction which have not used commercial software, have happened where a talented instructor has had both the ideas and the programming skills to complete the project himself/herself.

C. Exert leadership

College administrative leadership will play an important role in the successful integration of computers with instruction. Many issues raised by the integration of computers with instruction point to the need to **exert leadership**. For example, "The institution of lab courses where they don't now exist has implications for staffing and loading." Some solutions to room and computer utilization increase FTSE and attendant instructor responsibilities, and yet decrease faculty pay due the the current staffing/loading formulas. In addition, the competition for computer hardware among departments and programs demands planning and priority-setting. Many faculty wish they "had more direction about priorities, especially computer priorities." Additional space for labs of microcomputers or terminals is hard to find at most of the colleges in MCCCD.

College and district leadership can offer recognition and encouragement to faculty innovators, can encourage coordination and communication among the colleges, and can seek out discounts and site-licensing agreements with vendors. College leadership can provide help in managing and staffing the computer labs with qualified lab techs and providing on-going training opportunities for the lab techs, as well as for student lab assistants. This training should concern not only hardware and software, but also techniques for helping students in the lab setting.

"We need the leaders to extend us, not just support us. We need vision and leadership." The logical first uses of computers are those which do faster, better and cheaper those tasks we already do. Write a tutorial, for example, which can be a very sophisticated supplemental handout/exercise. Write a gradebook program. Write a theme grading program. These are not trivial uses of the computer; they are simply the first uses to which the computer is put in instruction. It is like defining the automobile in terms of a 'horseless carriage.' Many instructors understand that this is an early stage of development and express the need to have their horizons extended, to improve their vision of the future of instructional computing, and to provide "creative sparks, too." Faculty want vision, leadership, and support for undertaking the curriculum reforms that will come about as education responds to the demands of the information age.

Although this report is not about hardware, the need for more computer hardware was expressed many times in the interviews. While MCCCD has a rich hardware environment and a commitment for significant purchases over the next few years, the current hardware environment barely supports existing instructional applications. The commitment for hardware over the next few years will serve only a fraction of the uses that will emerge, as a wide variety of disciplines integrate computer activities. At the same time, the cost to integrate computers with instructions includes not only hardware, but also software, support and training. The costs beyond hardware are significant. Bobby Goodson, who has been an articulate proponent of computer use in school and a leader in several national educational organizations, has stated that computer expenses should go one-third to hardware, one-third to software, and one-third to training. (TechTrends, vol.30, No. 7, October 1985)

"We need vision and leadership."

Meeting the Needs: Recommendations

The previous pages articulated the needs of instructional computing along three themes: enable the instructor, provide programmer support, and exert leadership. The next pages will propose ways to meet those needs.

A. Recommendations to enable the instructor

1. Establish an Instructional Computing Information Fund (ICIF).

The **ICIF** will fund the development of information and expertise relating to instructional computing. Coordinated by C-IT, with annual priorities set by the District Academic Computer Users Group (DACUG), **ICIF** will provide a working combination of central support and decentralized expertise.

ICIF should be funded in the amount of $20,000 per year for five years.

Given the existing models, how is it possible to 'enable the instructor' when there are scores of different topics to be enabled in? Staff presentation, and even staff consulting, cannot be expected to fill this need completely. The variety of interests, hardware and software is so great that even tripling the district staff and distributing them one to each college would not meet the need that exists. It is an unreasonable job description for one person to be good at the wide variety of software on essentially four different computers (IBM-PC, Apple //, Macintosh, and VAX) , to continually learn new software and at the same time to prepare learning materials and teach it all.

With the help of staff, however, the enabling needs could be met by peer presentation and peer consulting. Staff would coordinate the awarding of resources through **ICIF** for the peer presentors and peer consultants, providing them with time, money, software, hardware, etc. For example, a faculty member (or staff, for that matter; let's use the entire available pool of talent.) would be given a stipend to research current CD-ROM technology, to explore uses of an existing system, and to prepare a 2-hour presentation on CD-ROM technology and its applications to education. This presentation would be given at several of the colleges and then archived at C-IT for future use. A peer consultant (faculty on release time) might be assigned to prepare one such presentation each semester, in additon to being 'on call' for his/her areas of responsibility. Others could be paid to develop annotated lists of software available to particular disciplines, to learn PILOT for the IBM in order to teach it to others, etc. The list of desirable projects would be prioritized annually by the DACUG.

There are some existing structures which make this an easy model to implement. C-IT has become a consultant resource and a demonstration center for new and current technology. DACUG needs more decision-making responsibility on instructional computing matters. The Staff Development Coordinator at each college currently plans seminars, demos, etc., meeting the personal and professional needs of faculty and staff. The combination of these three, with funds to allocate to the preparation and presentation of instructional computing topics each year, would provide a rich resource of material for the entire district. C-IT serves to keep the system working and to monitor the information development centrally to avoid total duplication of effort; DACUG insures that the information is pertinent, and the Staff Development Coordinators facilitate dissemination.

2. Establish an Instructional Computing Development Fund (ICDF).

The **ICDF** will fund the development of

instuctional computing software, courseware and templates. In addition ICDF will fund the integration of software, courseware and templates into curriculum. Coordinated by C-IT, with annual priorities set by the DACUG, ICDF will provide the support that instructors need in order to bring quality computer use into the curriculum. A peer review procedure should be used for the awarding of grants under ICDF.

ICDF should be funded at $100,000 for the first year (1987-88) and increase by $50,000 a year for four years.

ICDF will be coordinated and managed in much the same way as the ICIF described above.

2A. (Alternative to 2.) Award JCEP funds to the Instructional Councils, for five years, for instructional computing projects.

This proposal would serve two goals. First, it would provide a large infusion of support for integration of computing with instruction. Second, it would involve the instructional councils directly in the planning of computer integration on a discipline-by-discipline basis.

In particular then, award each instructional council project money for the 1987-88 school year. During the 1986-87 school year each instructional council will set up a planning/proposal submission process, so that funds can be allocated to specific projects by July 1, 1987.

The total award amounts would begin with $100,000 and increase by $50,00 per year for four years.

3. Use the computer itself as the information exchange.

A Bulletin Board System (BBS) should be created and used. It should be put on a VAX computer on the DECNet, so that it is accessible from any terminal (or micro as terminal) in the district. The BBS would be immediately accessible from every department office in the district. And since the telecommunications plan proposes wiring every office for data, as well as voice, the access would be universal by March 1988. Dial-up access to the BBS should be provided so that employees could reach it from home.

The BBS would consist of the following capabilities:

1. Dissemination of information
   - Index to software, hardware and computer expertise in the District
   - Lists of manuals and documentation and where to find them
   - Reports of conventions, seminars, etc.
   - Minutes of Board and committee meetings
   - Schedules of seminars within the District

2. Conferencing
   - Question and Answer forums on varieties of topics
   - Ability to have closed conferences for committees, etc.

3. Access to public domain software
   - Central storage of public domain software
   - Central distribution of internally developed software, courseware, templates, etc.

In the future the BBS would be a community service BBS available to the public, providing information about MCCCD's programs and courses, registration procedures, etc.

A BBS provides people with information when they need it. There is no need, then, to produce scores of indices, sent across every desk in the district. The updating of these indices is made somewhat easier because it is centralized and because there is no longer a distribution problem. A videotex (VTX) system for disseminating information has already been installed on a District MicroVax.

The question/answer forum provides one more way to decentralize the communication of information. It is just as easy to receive answers from another college as from your own.

Ready accessibility to public domain software and site-licensed software may encourage its use, resulting in lower software costs. Inter-college distribution of locally created software will be greatly enhanced.

4. District should maintain lists of software prices and discount options

The purchasing office should publish, in suitable forums such as the BBS, the current prices of commonly purchased software.

5. Form a public domain library of microcomputer software.

A public domain library of microcomputer software should be maintained on the BBS. In this way, the mass storage on the VAX is used to minimize the distribution costs of the library.

6. Develop and maintain a current directory of software in the district.

To fulfill the need for information about software owned within the district, a directory needs to be developed and maintained. This directory will also serve to provide inventory control of the software. To develop and maintain this directory is a large task, but one that many different groups within the district have an interest in.

A committee with representatives from Business Services, Auditing, Purchasing, and C-IT have already begun developing procedures to maintain a directory of software. This Plan endorses their effort.

This directory should be an information item on the BBS.

7. Continue print publications to disseminate information.

C-IT should begin a newsletter promoting its facilities for demo and information exchange. C-IT's newsletter will also serve to inform computer users about past, current and future seminars funded by the Instructional Computing Development Fund. The BBS itself should publish a 1 page flyer, bi-weekly, to promote new information available. Other print publications, such as The Computing Newsletter and the seminar schedules from ECS, should continue.

The print publications should use attractive layout, graphics and photos. After all, the BBS will be text-only.

The print publications should, among other information, point to information available on the BBS.

8. Host an annual MCCCD Computing Conference.

Training Systems hosted an annual conference at Phoenix College for several years. This conference should be revived by District Computer Services. It will provide one more avenue for the communication of information on computing within the district, provide another forum for the presentation of the seminars funded by the ICIF, and provide a face-to-face balance to the other communication media.

9. Bring C-IT to the colleges.

C-IT should provide a road show, a bookmobile. C-IT should take a selection of its software and hardware collection to each college for a week or two each semester, sponsoring an intensive week of seminars and presentations on new software, new hardware. This road show will be a vehicle for C-IT to disseminate its expertise. It will also serve to inform C-IT of the current questions and interests of faculty as they implement instructional computing.

10. Provide faculty with an array of development tools.

The current trend within the administrative computing environment is to put more computing tools and responsibility into the hands of the users. Likewise, instructional computing needs an underlying basis of commercial quality programs on which faculty can build their own applications. The instructor will choose, with some direction, one of the following tools appropriate to his/her current level of expertise and end goals.

a. **Application shell software,** such as spreadsheet or database. Instructor builds spreadsheet template for tax preparation or

databases of cell characteristics, for example, which students will use in a problem-solving manner. The results of this, when distributed, are sometimes referred to as 'value added software.'

b. **Templates of programming code for CAI.** The instructor puts in his/her own text and graphics. The decision/branching structure is pre-designed. The code could be an authoring language or other standard language. In the future, it is possible to imagine templates for the design of simulations.

c. **Authoring Languages**, such as Super PILOT or PC PILOT. The instructor writes code in a high level language specifically designed for CAI, on-line testing, drill, etc.

d. **Standard Computer Programming Language**, such as BASIC or Pascal.

The result of instructors preparing materials in this manner will be a lot of handout/good handout quality programs, programs serving specific educational goals. In the preparation, however, instructors will become more sophisticated in the development and design process, more sophisticated in the integration of computers with the subject matter, and more sophisticated in evaluating software.

Both C-IT and Training Systems need to develop seminars to promote and to teach these development tools.

11. Establish a team of peer consultants at each college.

Funded by release time, faculty would consult and assist other faculty in the instructional use of computers. The peer consultants may present seminars, help departments with long-range planning for computer implementation, or coordinate vendor demonstrations in addition to the consultant role.

By dividing the total computing picture into areas of responsibility, a few peer consultants could respond to most instructor questions. Glendale's experience with five peer consultants for a faculty of about 180 seemed appropriate.

B. Recommendations to provide programmer support

12. Establish college instructional programming resource centers.

These centers will provide programming, programming tips and design help to faculty who have ideas for software for their courses. In some cases, faculty can be directed to resources for developing their own product, as described in Recommendation 10 above.

I am leaving the careful design of these centers for later discussion. They will take on different characteristics at each college, of course, but it is my idea that these centers would help faculty develop level 2 and level 3 software. The centers would improve the quality of software already written, rewrite existing software for other computers, and write new software.

These centers may use student programmers to supplement an existing staff. These centers should be managed by the computer services department of the college, but work closely with the instructional design facilitator at the college. A faculty advisory board would set priorities for this center.

C. Recommendations to exert leadership

13. College Computer Groups become catalysts for planning.

The college computer user groups are advisory groups; and it is virtually fruitless for advisory groups to do serious planning in isolation. However, the computer user groups should assume the role of a catalyst for planning and a resource for planning.

The college computer user groups should be a forum for discussing the significant change issues that emerge: changing needs for instructional support (for example, help in getting site-licensing

agreements or in training lab technicians), changes in staffing/loading as a result of increasing lab-oriented courses, and other interdisciplinary computing support needs.

14. Formalize a royalty/copyright statement which serves to encourage faculty developed computing projects.

One of the best methods of encouragement is financial encouragement. Release time and summer pay represent two strategies. The possibility of future royalties represents another strategy. When an instructor conceptualizes a computing project, the main goal is to serve student's instructional needs. If that program works well, however, there is always the possibility of selling it to a publisher or marketing it oneself. MCCCD should let nothing stand in the way of the possibility of future rewards from instructor-developed computing projects. To that end, MCCCD should draft a royalty/copyright statement which serves to encourage faculty developed computing projects, even when these projects were done with college or district support.

An agreement should be developed which specifies, from the outset, the ownership and royalty arrangements. The agreement might be based on the following concept: "In exchange for MCCCD resources (release time, paid summer time, access to district resources, personnel, computers, software and programming expertise), MCCCD retains the right to use software developed in this project. Ownership of the software and all royalty rights fall to the instructor."

15. Bring to MCCCD speakers who challenge and enlarge our vision of instructional computing.

The annual computing conference, recommendation 8, offers one opportunity. Over the next few years, we should make creative use of telecommunications to involve innovators to challenge us.

16. District should negotiate software site licenses.

The purchasing office at District should have the responsibility to negotiate site licenses and software discount. The software that is licensed for use by all of the colleges in the district will be disseminated through the BBS.

17. Spend more money for microcomputers, less for VAX.

If the instructional use of the VAX computers continues to decline, as described in VAX Flight above, the current division of the bond money for computers and telecommunications will be obsolete. ITEC will need to authorize spending more of the allocation for instructional micro-computers at the campuses, and less for VAX computers controlled by the District Office which are used for predominately non-instructional uses.

18. Formally establish The District Academic Computer Users Group (DACUG) as ITEC's instructional computing advisory group and provide DACUG with a charter of duties and areas of responsibilities.

The areas of responsibilities would include:

a. Recommend priorities for the implementation of various elements of the District's plan for computing.

b. Review procedures relating to the purchase of computer hardware and software.

c. Develop an annual priority list for the Instructional Computing Development Fund and the Instructional Computing Information Fund.

d. Recommend policies on instructional computing issues, such as copyright, site licensing, loading/staffing, etc.

APPENDIX A: Preparation for Master Plan

Preparation for this Plan began in November, 1985 when Alfredo G. de los Santos Jr., Vice-Chancellor for Educational Development, asked for a faculty volunteer to prepare a Master Plan for Instructional Computing, a plan that would focus on non-hardware issues. Alfredo had articulated some of these issues 18 months earlier in a memo listing 15 questions on instructional computing. These questions are included below, in Appendix C.

After interviewing several faculty volunteers, Alan Jacobs, a Mathematics instructor at SCC, was selected to gather data and write the report. Jim Walters, Mary Lou Mosely and Naomi Story, of Alfredo's staff would assist, using a 'skunks works' approach. Jim coordinated the support. Staff development coordinators at each college provided liaison support.

Alan interviewed 92 faculty members, representing each college and nearly all departments, spending 50 minutes per interview, on the average. Faculty with a variety of computing expertise were interviewed. In addition a few administrators and staff were interviewed. The interview notes were coded, in order to quantify common themes. This report is based on those common themes.

In addition to the interviews, Alan used two other sources of information: the District Academic Computer Users Group, composed of two faculty computer users from each college, was revitalized in Jan, 1986 and met regularly during the Spring, discussing instructional computing issues. Alan also attended meetings of the SCC, MCC and GCC college user groups during this same time period. The issues raised in these user group meetings served to confirm and validate the interview data.

In April, 1986, a rough draft of the report was given to each person who was interviewed and a list of other interested parties: governing board members, presidents, deans, computer coordinators, etc. After receiving responses to the rough draft, the final report was written in July, 1986.

Appendix B: Interview questions and data

The Interview Questions (In no case was a person asked all of the questions.):
1. What is instructional Computing?

Is the following situation an example of instructional computing?

Use	Yes	Maybe	No
Computer as dynamic slide projector	66	1	6
Computer as classroom demo tool	70	0	3
Student does class assignment on computer	71	0	2
Instructor authors program for instruction	57	4	12
Colleague tries out above program	49	5	14
Instructor uses WP to write a test	34	9	29
Dept secretary types test	20	4	47
Student takes placement test	23	8	42
Student registers for classes	5	3	65
Student searches job database	15	7	51
Student uses computerized card catalog	50	7	16
Student uses computer for career advice	27	11	35
Dept chair does schedule on computer	7	0	64
Fitness center uses computer to manage	34	3	26
Student checks out non-assigned program in lab	23	0	1

2. What are you doing now with computer technology?
3. What projects do you want to do?
4. What resources will you need to accomplish your projects?
5. What kind of support should the college or district be in the business of providing to instructional computing?
6. How will each of the following change over the next 5 years?

    a. Student's computing abilities.
    b. Computer hardware.
    c. Access to computers.
    d. The content of your courses.
    e. Your delivery style.
7. How should we determine which projects receive development support?
8. How should we disseminate information about projects?
9. What role does institutional support have in quality control?
10. What are the issues around copyright and royalites?
11. Any other thoughts on instructional computing?

Appendix C: Fifteen questions and a response

In his fifteen questions Dr. Alfredo G. de los Santos Jr. asks whether and to what extent the District should become involved in the development of educational software. In the process he asks some very challenging questions about how this would work.

As a general response, the District should not become a software publisher nor an overt developer of commercial-quality software. Following a trait of America's best-run companies described in the book In Search of Excellence, MCCCD should 'stick to the knitting.' MCCCD's software development should focus on meeting the educational needs of students in Maricopa County, not on the future marketability of that software.

There is plenty of room, however, for software development which falls short of commercial quality. As the recommendations 2, 10, 12, and 14 in this Plan suggest, the District should support the development of handout quality, good handout quality and distribution quality software by faculty and staff.

There is also plenty of need for support for the integration of current software with curriculum.

1. What criteria should we use to determine the areas/disciplines for which software/courseware should be developed?
Faculty recognize that the peer-review process, despite its flaws, is the most valid way to prioritize projects. Projects from a wide variety of departments must be funded, because implicit promises for computer use have been made through the FCLP.

2. What criteria do we use to determine which faculty we would 'encourage'/support to develop software/courseware? Interest? Expertise in discipline? Expertise in computer use? Expertise in instructional design? What?
Faculty of many degrees of expertise want to integrate computers with instruction. Based on individual instructor interest, they should be directed to a range of development tools or existing software packages.

3. What kind of fiscal support should the District provide? How should we pay for development? Release time? By unit, i.e. contract for development of a module? How?
See recommendations 1, 2, and 2A.

4. What type of staff development activities should we provide for interested faculty?
See recommendation 8, 9, 10, and 15.

5. What is the best way for us to prevent/reduce duplication?
Each instructor approaches his/her material in a unique way and this variety of approaches is carried over to computer work. Just as there is not one correct way to present a given concept, there is not one correct way to do CAI. In this sense, then, duplication of effort is not something to be avoided -- precisely because it may not be duplication at all. A potential software author needs to know what is available currently (see recommendation 6); but he/she also needs to be able to choose an alternate approach. When the software is to be handout or good handout quality, duplication may even be encouraged so that future software can be built on the best ideas of each.

6. Should we expect faculty to do 'programming' or should we do the programming for them?
See recommendations 10, 11, and 12.

7. Which is the best way for us to disseminate the finished product to other faculty teaching in the same area(s)? What should we do to encourage/teach other faculty to use the finished product?
See recommendations 3, 5, 6, 8, and 9.

8. Should we write Request for Proposals (RFP's) for development of software/courseware which is badly needed?
The judgement 'badly needed' would be made by faculty. These same faculty should pursue the development of the needed software/courseware.

9. How do we relate our development efforts with commercially produced courseware?
We need to be aware of what is available commercially before we invest time and money in our own software and courseware development.

10. Who decides what software/courseware should be supported? My office? ECS and my office? Who?
C-IT has become the district focus of instructional computing, but a peer review process should be used to determine which projects receive support. This could become a function of DACUG, as suggested by recommendations 1,2 and 18.

11. How do we fund such development?
See recommendations 1, 2, and 2A.

12. Should we approach textbook publishers/software houses, etc., for support?
No. Neither should we stand in the way of district software/courseware being brought up to commercial standards by others.

13. The software/courseware should be developed to operate on what hardware/computer? Who decides?
Faculty with staff consulatation, will determine the appropriate hardware after evaluating the following:

- current and future hardware availability
- hardware capability vs. program design
- availability of support and expertise.

14. What about copyright? Who owns the copyright for software/courseware developed with District support?
See recommendation 14.

15. Should we attempt to develop modules for courses, whole courses, supplemental materials for textbooks, etc.? Who decides?
Jim Walters, of C-IT, has a wonderful educational fantasy about school as video-arcade. A person would plunk in quarters, practicing skills and learning concepts with each additional quarter. After a certain mastery was reached, out comes a receipt for 3 credits of College Algebra, or whatever.

My sense is that we're a long way from this fantasy only because we do not know what College Algebra would look like on a video arcade. We only know what it looks like in books. For this reason, I think we should stick to topics, modules and supplementary maaterials. Perhaps in five years we'll know what a whole course would look like on computer.

Appendix D: Who was interviewed.

Phoenix College

Gail Jamieson	Art
Harry Reinken	Business
Margaret Zinky	Business
Pat Moyer	Chemistry
Fred Shaver	Electronics
Don Richardson	English
Angela Ambrosia	Health
Louise Jones	Nursing
Marsha Widdows	Home Economics
Robert Sullivan	Humanities
Lynn Marks	Library
Betty Field	Mathematics
Ed Chandler	Mathematics
Bill Anderson	Physics
David Dalby	Psychology
Kathie Driscoll	Reading

Glendale Community College

William Dotterer	Accounting
Albert Ellis	Biology
Jim Jacob	Biology
Dorothy Wooley-McKay	Biology
Mark Montanus	Business
Lyle Langlois	Business
Phil Moloso	Business
Shirley Petras	Business
Chuck West	Chemistry
Marilee Murray	Chemistry
Ron Frost	Counseling
Paul DePippo	Economics
Hannes Kvaren	Economics
Manny Griego	Electronics
Chris Barker	Electronics
Joyce Wingersky	English
Jan Boerner	English
Robert Johansson	English
Holly McKinzie Beene	Library
Ed Hoff	Mathematics
Steve Cooper	Psychology
Pat Bradley	Staff Dev Coordinator
Bonnie Nelson	Instructional Design
Larry Christiansen	Dean

Mesa Community College

Darlene Swaim	Art
Sharon McFall	Business
Bob Autrey	Business
Linda Cronquist	Business
Stan Alf	Drafting
Gerry LaBell	Electronics
Harold Miller	Engineering
Doyle Burke	English
Donella Eberle	English
Gene McMullin	History
Jim Theilman	Library
Chuy Carreon	Mathematics
Barron Arenson	Physics
Jim Ferguson	Psychology
Gwen Rowley	Reading

Chandler-Gilbert Education Center

Margaret Haddad	Assistant provost
Mary Alcon	Business
Alice Conkwright	LAC

Maricopa Technical Community College

Rick Sheets	LAC
Marlowe Sperstad	Electronics
Myrna LaFleur	Health
Virgil Mathes	Psychology
Joyce Mulholland	Nursing
Carolyn Keith	VESL

South Mountain Community College

Joanne Alden	Business
Greg Medrano	Business
Zarina Fernandez	Business
Duane Brickner	Business
Julie Bertch	English
Rick Meyer	Mathematics
Jerome Garrison	Music
Maria Hesse	Transfer Program
Mary Schnell	Psychology
Faye Hill	Word Processing

Scottsdale Community College

Joe Garcia	Admin. Justice
Dennis Massion	Biology
Jerry Booher	Business
Jim Hogan	Business
Diane Dias	Business
Don Snow	Chemistry
Phil Silberman	Chemistry
Roseanne Dlugosz	Early Childhood
David Weaver	Electronics
Fara Darland	English
Sharon Howard	Library
John Losse	Mathematics
Rita Richards	Mathematics
Charles Sessions	Music
Gene Schmidt	Psychology
Mike Morgan	Psychology
Rodger Slater	Reading
Kimb Williamson	Theater

Northeast Valley Education Center

Ken Roberts	Assistant Provost
Gene Rister	English

Rio Salado Community College

Bill Kiernat	Data Processing, History
Pat Haas	LAC

And in addition, the following groups:

MCC Computer Users Group
GCC College Computer Committee
SCC Computer Users Group
Academic Computer Users Group for MCCCD

Appendix E: Computer Literacy in Maricopa County High School Districts

HS District	% of computer literate High School graduates1986-90	Kinds of experiences
Phoenix Union	100%	°All students will get 1 week computer literacy per year, for four years, released from English course. °15 - 20% will have had min. 1 sem. course in computers °Computers are available to other disciplines and are used in all Chapter I classes, for example.
Tempe	100%	°JHS has a 1 sem course in computer literacy. °1st year Mathematics has a 5-week unit on computer literacy. °150-200 Apple computers in each school are available as supplementary to curriculum. °20-35% will have had min. 1 sem. course in computers.
Mesa	35-75%	°15 - 25% will have had min. 1 sem. course in computers. °Computers used sporadically to supplement curriculum. °JHS offers an elective cours in computer applications.
Scottsdale	100%	°7 & 8th grade has computer literacy course. °Each dept will have 1-5 computers by 1986. °30-40% will have had min. 1 sem. course in computers.
Paradise Valley	50-60%	°7 & 8th grade has 1 sem computer literacy course. About 40% of students take it. °25-35% will have had min. 1 sem. course in computers °Computers are not used outside Mathematics and Business.
Deer Valley	80%	°"Mass exposure" to computers is a priority. °Will cycle all business students thru micro experience.
Glendale	50-60%	°Computers used in Chapter I, Voc Ed, Spec Ed, Industrial Arts and Basic Skills °Will establish learning centers with computers. °About 50 computers per school.

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